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ABSTRACT

This paper explores ways in which technology (especially microcomputers) can improve the access to and utility of educational data for school improvement efforts. The paper focuses on the product and project options available to the Northwest Regional Educational Laboratory's Database and School Profiling program, which offers technical and informational assistance to educational agencies. The paper first notes that technology's value lies in four areas: making task performance more efficient, producing higher quality products, automating difficult procedures, and extending capabilities. The paper then reviews six essential steps in the school improvement process as identified in the effective schools literature. Of these steps, data collection and profile production appear best suited to automation, though reviewing profiles and developing improvement strategies are also important, complex steps that could benefit from the application of appropriate technological processes. The final portion of the paper is devoted to examining three specific data gathering and analysis needs of agencies engaged in centralized school improvement planning and four needs of agencies committed to supporting decentralized, local school improvement efforts. The problems, appropriate technological applications, and potential technical assistance strategies are identified for each of the seven needs. (PGD)



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THE Northwest Regional Educational Laboratory

PROGRAM REPORT

# Applications of Computer Technology in School Profiling and Databased Decision Making

ED277159

U.S. DEPARTMENT OF EDUCATION
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Evaluation and Assessment

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We have witnessed great changes in microcomputer technology over the last ten years that could have impact on school improvement efforts. We can now purchase an inexpensive machine that fits easily on our desktop and runs a wide range of mature application software. A fast processor allows our desktop computer to run statistical and survey analysis software that were once limited to large university computers. High capacity hard disks coupled with elegant database management packages are revolutionizing the way we manage information. Laser printers and page composition software are having dramatic effects on the visual quality of printed material.

For the most part, the basic technologies have existed for many years on larger computers. What has changed is that they have become more affordable, easier to use, and more accessible. These are important prerequisites in education, but the big money is in business applications so developers tend to ignore educational applications.

The purpose of this paper is to explore ways in which technology, especially microcomputers, can improve the access to and utility of educational data in school improvement efforts. The options outlined in this paper offer a range of projects and products that could be undertaken by the Database and School Profiling program at the Northwest Regional Educational Laboratory (NWREL). Since the program cannot support all these projects, this will serve as a planning paper. Any suggestions to help set priorities among the options presented here will be appreciated.

The audience for this paper includes project staff, advisory groups, state evaluation and assessment directors, and any district staff charged with the development of profiles or databases.

## A Context for Technology Options

### Appropriate Roles for Technology

Technology is worth considering as part of the solution to a problem if it can do one of four things:

- Make a task more efficient
- Produce a higher quality product
- Automate difficult procedures
- Extend our capabilities

For example, we use word processing software because it lets us write faster. Our writing improves because we can focus on the message and not the process of capturing it on paper. For those of us with atrocious proofreading, the word processor spelling checker can automate that step. With a laser printer we now have the capability to incorporate bold, italics, and large fonts which can help draw the reader' attention to the organization of the paper.

**The School Improvement Process**

There is no single approach to school improvement to guide this discussion. Some models attempt to promote effective teacher behaviors (e.g., Stallings, 1980) while others emphasize the characteristics of effective schools (e.g., Blum & Butler, 1985). Both approaches are evident in the Northwest region but I will focus on the effective schools approach which seems to predominate.

Most effective-schools improvement models incorporate a monitoring system to assess how a program is doing and an action system for fine tuning the program or implementing changes. At the school level, the monitoring system frequently results in a school profile. The action system is often based on a schoolwide improvement team. The following informal task analysis suggests the steps that would be followed in such an approach.

1. *Plan the profile.* Develop a profiling plan, determine the indicators, and select or develop instruments.

2. *Collect, manage, and analyze data.* Assemble existing data, collect new data, build a database, aggregate and disaggregate the data.

3. *Prepare and distribute the profile.* Select data to highlight, prepare tables and graphs, write narratives, prepare the profile for printing, distribute the profile to affected parties.

4. *Review the profile.* Interpret the data, set priorities or goals, disseminate the results.

5. *Identify strategies.* Diagnose the problem, identify possible strategies, select appropriate strategies, develop implementation plan.

6. *Implement improvement strategy.* Implement the plan, monitor implementation, support the implementation.

The model emphasizes an ongoing system, a cycle that repeats itself periodically, perhaps annually . The monitoring system focuses on changes in selected indicators of performance over time (Blum & Butler, 1985; Cooley, 1983). Since existing data and new data must be merged and organized, the process often requires a computerized information system (Burstein, 1984). This is not to imply, however, that such a rational model is an adequate representation of how educators make decisions based on data (Kennedy, 1984).

While the choice of words in this analysis implies school level improvement efforts, the underlying systems model can be applied to classroom, district, or state level decision making as well.

When we consider the ways that technology can help in such a school improvement system, our attention is immediately drawn to the data collection and profile production phases. These are the tasks that are probably most appropriate for automation given our current technologies. Still, the task analysis helps remind us that the monitoring system is part of a broader process and must be developed with the larger goals in mind. We should not overlook applications in other areas, such as

reviewing the profile or developing strategies, since they are certainly as important and as difficult.

### Regional Needs

Over the last year, Database and School Profiling program staff have conducted a regional conference (NWREL, 1985) followed by several needs assessments (Coe, 1986) and advisory committee meetings. I reviewed the notes from these efforts to identify the key issues and concerns, expressed by NWREL clients, that are relevant to technology applications. My analysis showed that there is high interest in applications of technology but that specific concerns are driven by the role of the client and the approach taken to supporting school improvement.

*Centralized approach.* Some states and school districts have elected to centralize the production of school profiles or at least provide access to assessment and other centrally managed data. Intermediate agencies or consortia may carry out this role in areas with many small districts. A school profile may help create the accountability pressure needed to initiate improvement efforts (Armstrong, Anderson, Odden, & Huddle, 1986). It also relieves school staff of some data collection burden and leaves more time for developing improvement strategies. These agencies are concerned with:

- Increasing efficiency and quality of centralized profile production
- Improving local access to existing centrally managed data
- Developing comprehensive accountability databases

*Decentralized approach.* Schools with improvement programs or agencies which view their role as supporting local improvement efforts have somewhat different concerns that reflect their decentralized approach:

- Developing school-based information systems
- Improving the efficiency and quality of local school profiles
- Scoring and analysis of indicators
- Selecting appropriate instruments and strategies

The remainder of this paper devotes a section to each of these issues. In each section, the problem, appropriate technological applications, and potential technical assistance strategies are identified.

## Increasing Efficiency and Quality of Profile Production

### Problem Identified

Some states and a number of districts have elected to promote school improvement by centrally producing school profiles and distributing them to schools periodically. A typical profile combines contextual indicators, like ethnic mix, and performance

indicators, like achievement, and displays trends over time or comparisons to some standard.

There are three rationales for central production of school profiles . First, the profile can serve as an external stimulus to generate interest in school improvement, especially if the profile can be tied to a formal improvement process. Second, collecting and analyzing data is a difficult and very time consuming task that can be more efficiently accomplished by central staff. Third, if profiles are developed centrally, school staff can focus on interpreting the profiles, setting goals, and implementing improvement strategies.

Once a state or district begins to design the profiling system, the need for trimming costs becomes quickly evident. Producing a profile requires a considerable commitment in resources. Data from different sources must be collected, merged, aggregated, and displayed. Current technology such as microcomputer database software and desktop publishing with laser printers can automate the process. One district with 76 schools spent $107,000 to develop a comprehensive profiling system and anticipates spending about $29,000 annually once the system is fully automated.

**Applications of Technology**

The procedures used by Sacramento City Unified School District provide an excellent example of appropriate applications of technology to automate profile production. District staff merged existing data from three sources with a microcomputer relational database. Responses to a student survey were entered using a desktop scanner. The standard text for the profiles was entered using a popular word processing package with good support for laser printers, and merge printed on a laser printer with the school data file, much as form letters are produced. Graphs were produced with a business graphics program and printed on the laser printer. The resulting profile combined quantitative and qualitative data from a number of sources in a typeset, easy to read format.

**Technical Assistance Strategy**

We could develop a Profile Production Guide to assist districts or states that are preparing profiles. This guide would illustrate options for reducing production costs and improving the technical quality of profiles. It would be aimed at the staff of moderate to large school districts and of state departments.

The guide would document the experiences of states and districts that have already automated production. It would also discuss important considerations in selecting hardware and software. It would raise technical issues such as how to obtain and display normative or comparative data.

We would be able to write the Profile Production Guide with relatively little effort. Preparation for the guide would require site visits to perhaps four state or local agencies. Some testing of recommendations and a literature review may also be required.

## Improving Local Access to Existing Data

### Problem Identified

There is considerable evidence to suggest that user involvement and access is critical to the success of any information system (e.g., Craig & Bank, 1985). Yet, most district and state information systems were developed with all the data flowing upward. The providers of data in these systems perceive little utility in the information system, have little or no access to the data, and have little stake in ensuring the accuracy of the data. Currently, the school reform movement provides one stimulus for renewed interest in using existing data (Burstein, 1984).

### Applications of Technology

There are a number of strategies that have been proposed to provide school access into district data or district access to state data. These include:

1. *Data on floppy disk.* Provide data files on floppy disks so that the user can load the data into any application software with which he/she is familiar (e.g., California Department of Education, 1986).

2. *Browsing system.* Provide data and database software on a floppy disk so that the user can conduct queries with minimal training and little computer experience (e.g., SWRL, 1985). The program should include statistical or graphic capabilities to augment the query language.

3. *Database management package.* The state or district distributes database software to local sites at minimal cost. During the year, local staff enter and edit data. The staff can print reports and query the database at any time. At the end of the year a copy of the data disk is sent to the state or district office (Deck, 1985).

4. *Bulletin board.* Manage a bulletin board or electronic mail system and allow users to download data files from the host computer and exchange messages with other educators.

5. *On-line record entry and retrieval.* Staff enter data into the database using terminals connected to the central computer. Staff may also retrieve individual records at the terminal, but may not be able to summarize data to answer questions.

6. *On-line interactive query.* Staff may enter query language commands at a terminal connected to the host computer and print summary reports to answer questions about the database.

**Technical Assistance Strategy**

We could prepare a report illustrating the differences in assumptions, goals, costs, feasibility, and impact of each approach. To prepare a report describing and comparing these approaches, it would first be necessary to identify agencies implementing them and to conduct case studies. The report would include brief discussions of these case studies but focus on a comparison of the options and a discussion of the issues in implementing them.

## Designing a Comprehensive Accountability Database

**Problem Identified**

State departments of education and large school districts in our region are beginning to reevaluate their database management systems. Many moderate to small sized districts are considering establishing databases. One of the primary forces driving this renewed interest is pressure for accountability and pressure to evaluate the impacts of the school reform movement. These agencies are collecting potentially useful data, but the data are often gathered by different departments in aggregate form and organized in incompatible ways. These agencies usually experience difficulty in answering many policy makers' questions and find that the aggregate data are not very useful to those who have provided the data.

**Applications of Technology**

Over the last ten years, great improvements in database design techniques, query languages, and storage technologies have evolved in the university and business environments (e.g., Date, 1985). Relational database design concepts are appropriate for the dynamic kind of information systems that these agencies need. So-called Fourth Generation Languages (4GL) like Focus, a database system, and SPSS, a statistical package, provide powerful query tools to analysts who have content area expertise but limited data processing experience.

**Technical Assistance Strategy**

Several state departments and large districts are either designing or considering a more comprehensive assessment database. We could serve a networking role to facilitate those efforts and develop selected issue papers. The differences in the decision-making context for states and districts may, however, require that the target audience be more narrowly defined.

Networking activities would start by identifying state and district staff within the region interested in these issues. States and districts outside the region who have made contributions in the area would also be identified. This group would form the basis for a mailing list, for case study sites, and for advisory groups.

One paper could review the emerging policy literature (e.g., Cohen, 1986; Kirst, 1984) and published descriptions of such efforts (e.g., New Jersey Educational Computer

Network, 1983) to develop a framework for discussing the issues and alternatives in designing such systems. The issues are as much political and policy bound as technical, so it would necessarily cover more than technology. Interviews with key state or district staff should also be included.

Another paper might discuss the relational database design concepts as they relate to assessment and other indicator data. A case study with a selected state or district could demonstrate how these concepts promote a database that can support a wider range of queries.

A third paper might report recent efforts to conduct a national study using district databases (Wood & Gabriel, 1986). The paper would highlight the characteristics and utility of different types of information systems found in school districts.

## Developing a School-Based Information System

### Problem Identified

The school reform movement has focused our attention on the importance of school level decision makers in promoting school improvement (Cooley & Bickel, 1986; Blum & Butler, 1985). School improvement approaches based on this premise promote a planning model which combines a school-based monitoring system and a process for translating the results into educational change.

School staff, however, are typically ill prepared to design and implement a database without some assistance. There are no simple guidebooks to follow, no tutorial. The skills and knowledge needed are not typically part of their training.

### Applications of Technology

Dramatic changes in the microcomputer industry have made it practical to implement sophisticated databases at the school level. Hard disk drives with 20 megabytes of storage now cost $500 or less. Database software for small computers has matured and some packages sport capabilities that rival products available on much larger machines.

From the theoretical work of computer scientists and the practical experiences of database managers in the business world, many techniques and tools have evolved to guide the design of databases that are easy to manage and to query. The relational database model is particularly relevant for school-based monitoring systems.

Recent research on the utilization of assessment information in educational decision making provides a conceptual framework for how such systems can function in the context of the school (e.g., Cooley & Bickel, 1986; Williams & Bank, 1984).

### Technical Assistance Strategy

No practical guide exists to help the practitioner develop a school-based information system. The purpose of such a guide would be to organize relevant literature in

evaluation and computer science as well as case study descriptions into a set of procedures and guidelines for database development. The guide would include the following:

- Identify characteristics that should be present in the district
- Describe a process for setting priorities and designing a database
- List appropriate indicators and their characteristics
- Illustrate relational database design concepts
- Describe models of different approaches
- Review microcomputer software and hardware considerations

This project would require considerable effort and should be envisioned as the first step in an ongoing strand of work. For example, after the guide is completed, workshops and consultations could be presented regionally.

## Improving Quality of Local School Profiles

### Problem Identified

School staff are rarely trained in the collection, analysis, or interpretation of data. They may be unsure how to proceed or may use questionable practices in preparing profiles. They may be familiar with instructional applications of computers but unfamiliar with data processing applications. School staff welcome good examples of profiles and practical guides for preparing them.

### Applications of Technology

While a school may not have the resources yet for designing relational databases or doing desktop publishing, there are many less expensive and less demanding options available that can simplify or improve profile production. These include:

- Analyzing survey data with a file manager or statistics program
- Analyzing performance data for special groups with a simple student level database
- Managing summary data, perhaps at the classroom level, over several years with a file manager or business graphics package
- Graphically displaying key findings with a business graphics package

**Technical Assistance Strategy**

The school profiling guide series (Deck, 1986; Anderson, 1986) is an appropriate vehicle for disseminating this type of information. A Microcomputer Applications guide could be developed with minimal effort. The primary purpose would be to supply good examples of the applications suggested above that schools could try to duplicate on locally available software.

At least one such computer profiling guide (Alaska Department of Education, 1986) apparently had limited impact. While the guide was comprehensive in detailing the steps for using a specific database package for profiling, it did not include pictures of data entry screens, printed reports, or other examples from a working database. Perhaps some training on a generic database is necessary before the staff can focus more on designing the local database and less on how to set up the computer program.

Another approach would be to develop templates with sample data for each application on selected software commonly used by schools (e.g., Deck & Owen, 1984). A training module would give experience in applying the templates. Participants would be encouraged to customize the templates to fit their own needs. This approach would require more effort to produce (and pilot test) templates and training materials for at least one package on both the IBM PC and the Apple IIe. This option should be viewed as the logical next step after the profiling guide.

## Selecting Instruments or Improvement Strategies

**Problem Identified**

School staff typically have limited information about available instruments to operationalize an indicator and about promising improvement strategies to implement. Rather than encourage each school to develop their own instruments or strategies, we should provide information about what is available and how it can be used best.

Reviews and other printed materials continue to be an effective means of disseminating information, particularly when the knowledge base is stable. The school reform movement, however, has stimulated much activity at all levels in education, making it difficult to find out what is new or relevant to the local situation. Updating, reprinting, and disseminating up-to-date reviews of school climate instruments (Arter, 1986), for example, can become costly.

**Applications of Technology**

The success of the telephone system attests to the impact telecommunication has had on our lives. In education there has been considerable interest recently in teleconferencing, electronic mail, and bulletin board systems as a means of maintaining a network of people with common interests and a need to share information. ED-LINE and ORE-NET are two such systems operating in the

Northwest. There may be ways to better use these systems to disseminate information.

One solution to the high cost of keeping print materials up-to-date is to supply information on floppy disk in a bibliographic database. The cost of duplicating a floppy disk that stores as much as 150 pages of text can be less than a dollar. The database software would allow the user to search for the type of instrument desired and print the results of the search, much as a librarian would search the ERIC database. NWREL has developed an Information Resource Database that might serve this purpose. Of course, floppy disks are not as convenient to use as paper, and many agencies would not have a compatible computer or any computer at all.

**Technical Assistance Strategy**

There are a number of products and activities at the NWREL and within the region that could be served by a bibliographic retrieval system or by better use of existing telecommunication networks. The first activity would be to analyze the kinds and quantity of information relevant to designing instruments and developing improvement strategies. The second activity would be to determine what communication systems exist, the purposes of those systems, and how many agencies each serves. The third step would be to analyze the feasibility and utility of disseminating information in new ways. The final step would be implement the approach, if any, that was judged most practical.

## Scoring and Analysis of Performance Indicators

**Problem Identified**

Extensive scoring and reporting systems have been established for standardized achievement tests and, to a lesser extent, criterion referenced tests. Thus district, state, or publisher scoring services are available for basic skills testing. This is not the case with other school improvement indicators, however, such as:

- Higher order thinking skills
- School climate
- Student self-concept
- Student attitudes toward school
- Parent or community attitudes toward school
- Staff attitudes
- Graduate follow-up survey

Most profiling efforts include attitude surveys or other indicators that require much staff time to score and analyze. Manual scoring of these instruments is tedious and a great deterrent to widespread use.

**Applications of Technology**

The indicators listed above usually can be assessed with paper and pencil instruments. In the past, expensive and cumbersome scanners connected to mainframes were required. Today, desktop scanning equipment (optical mark

readers) are readily available at reasonable prices with supporting software for microcomputers.

Such a system was developed in a cooperative effort between NWREL and the Washington Office of Superintendent of Public Instruction (Deck & Rasp, 1984). The state adapted the senior survey from the national High School and Beyond study for local use. NWREL developed a low-cost scoring system for the survey using a desktop scanner and statistical software. A school or district administers the survey and sends the answer sheets to NWREL. The school receives a summary report and an interpretation guide when the answer sheets have been processed.

There are other methods to conduct surveys, particularly in surveying the community. With a telephone survey, for example, computers can be used to dial, prompt the interviewer, and record responses. Some attention to alternatives to paper and pencil instruments may be warranted.

**Technical Assistance Strategy**

There would seem to be two approaches to establishing scoring services in these areas: building local capacity for processing these instruments or providing a low-cost service for selected instruments. Each has its advantages.

To build local capacity, the first step would be to review the available scanners and survey analysis software for microcomputers. The next step would be to develop a training module which presents the findings of the reviews and describes how to establish a small scoring operation. The final step would be to conduct the training at regional conferences or other settings.

To establish a regional scoring service, NWREL would select good instruments to measure key constructs like school climate based, in part, on reviews by the NWREL Test Information Center (e.g., Arter, 1986; Arter & Salmon, 1986). A scoring program would be developed to handle each instrument. A reporting program would be written to present the results in a readable format with historical, district, or national comparisons if possible. Interpretive and technical information on the instruments would be assembled.

The regional scoring service approach would benefit schools or districts of any size. No school staff time would be wasted trying to develop a system that would be used perhaps once a year. The local capacity approach, on the other hand, would give schools a wider array of instruments to choose from and would promote local involvement.

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